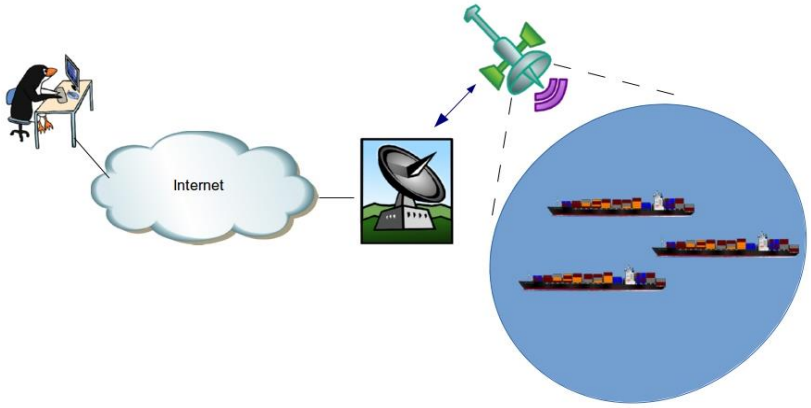
" Relay2Sat "

Vers. 1.2

A Content Delivery System for (not uniquely) Maritime environment



INDICE

Introduction

This document contains information about Relay2Sat (**R2S** for short) which is a Content Delivery System managed by an integrated, simple and reliable Content Management System. This system has been conceived for being used in any business environment requiring content transmission toward a default set of terminals or end points. It is particularly adapt for Maritime environment where a numerous vessel fleet is worldwide operating and requiring easy, reliable and cost effective content transmission.

R2S features are described jointly with its general usage from both user and Operator side.

Detailed information are also provided about the relevant Content Management System (CMS) which has been developed ”ad hoc” aiming to provide a simple service handling.

What R2S does

R2S service allows customers the capability to transfer in real time toward a predefined set of satellite terminals any kind of information, being it a document, an audio/ video file, images, etc.

The content transmission is independently decided and managed by the customer under the subscribed rules for the intended use of the service. Any transfer can be carried out through any location having access to Internet after successful authentication. All remote satellite terminals being entitled to receive contents have to be previously configured and enabled.

The picture schematically represents how the R2S is provided.

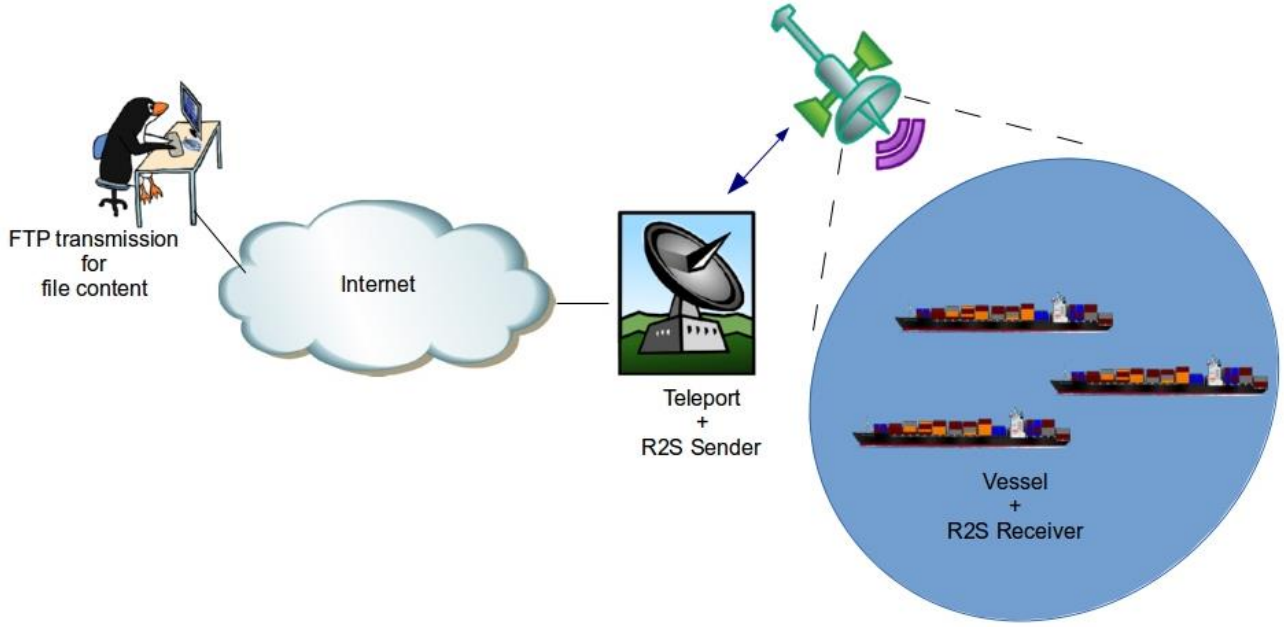


Fig.1 – R2S scheme

Any kind of satellite coverage can be used to provide the service. The typical one is the global worldwide coverage which is available both in Ku and C Band, both of them handled by Network Operation Centers (NOCs) on a 24/7 along a yearly temporal base.
As R2S service just "moves" IP packets, it means that any satellite platform or access type to satellite is viable to support it.

The R2S characteristics are hereafter shown:

- The customers can always autonomously submit its own content; they just need any type of Internet connection.
- The content transmission toward the final destinations is very fast as it occurs as soon as the files are available at an FTP server.
- R2S relays on a Reliable Multicast Protocol which provides an efficient transmission at satellite guaranteeing as well the correct reception of the content; in case of satellite interruption the content may be retransmitted. UDP is the used protocol.
- The correct reception of a content from a remote terminal is locally logged. This information is also centrally recorded in a MySQL database (central log). This feature allows both customers and NOC personnel to monitor the service status.

The particular aspect regarding file transmission through R2S is that it doesn't use FTP protocol (relaying on TCP) as this implies, being an Unicast protocol, that for a large set of terminals (example, vessels) the same session (file transmission) has to be replied as much times as the number of vessels.
Satellite channel is an expensive resource, so, it is preferable to draw attention toward other more efficient protocols being based on UDP but, contemporaneously, guaranteeing a reliable transmission, which is the remarkable benefit when TCP protocol is used.
This is where **NORM** introduction comes from which is integrated in R2S. Multicast transmission is used. NORM has been developed and maintained by**, Networks and Communication Systems Branch,** being part of the. **U.S. Naval Research Laboratory.**

The current R2S version implies the usage of satellite usage to send a multicast content, which entails the presence of a teleport having master antennas to implement the relevant satellite links.

In case of scenarios where service requirements imply no satellite channel, R2S can anyway be easily upgraded and used to realize multicast transmission also on Internet through terrestrial tunneled channels.

R2S components

The R2S service is based on functionalities which are provided by some application components being integrated each other. This functions are:

- an FTP server, which allows the customers to be able to transfer (upload) their own content in a dedicated storage space after having been authenticated (login)
- a Web server, used by the NOC personnel to manage the service. It also allows the customers to know the service status, namely, to know which and how many files have been actually received by each remote terminal
- a PHP server, which acts as a central engine for the Content Management System (CMS) that has been specifically developed to manage R2S
- a MySQL server, which is the database supporting R2S logs and functions, collecting all the historical and current service status and providing evidence of correct reception from remote terminals
- an application in charge to send contents to satellite, namely, NORM, (Negative acknowledgment-Oriented Reliable Multicast), which is described by IETF in RFC 5740 and 3940. Contents are transmitted in real time after any upload triggered by the customer (using any FTP client). NORM application is used both as SENDER and as RECEIVER (remote terminals side where a PC is running a Norm receiver process).

Fig.1 shows what above described.

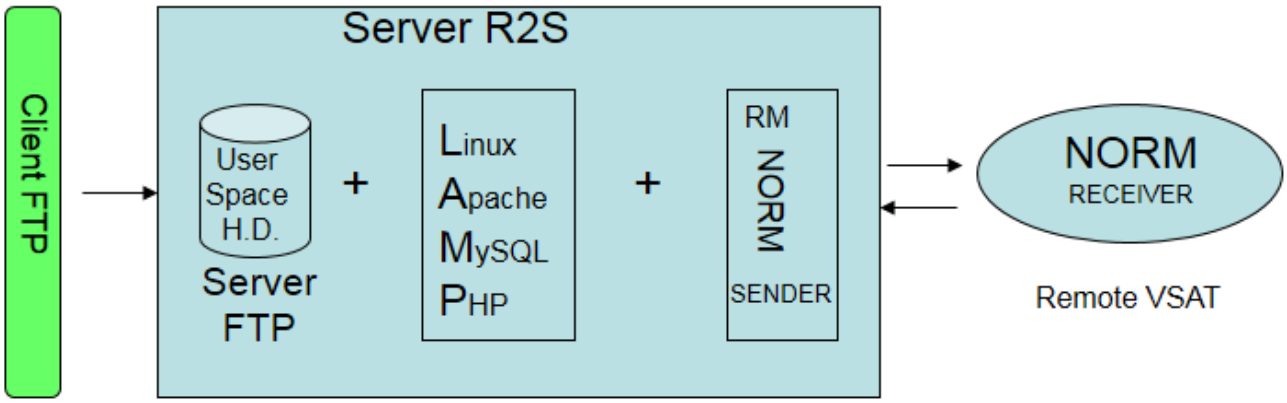


Fig.2 – R2S components

Using R2S

Once the customer subscribes Relay2Sat, the following actions are performed by the Service Provider managing R2S. Some definitions are firstly given to help on understanding the service flows.

For server “R2S " it is meant as an abstraction given by the integration of manifold application server cooperating each other.

For “Hotbox " it is meant as a software control mechanism being provided internally to NORM process being able to withdraw from the user assigned repository only the new posted content; these files are managed by Norm-Sender process and sent toward the satellite channel(s).

The flows are hereafter described.

The specific customer account is created, which means to prepare both FTP and Web CMS configurations; a dedicated hard disk space is allocated together with the login credential for access.
All necessary processes are activated, both on Teleport side (R2S-Sender) and on each of the remote terminals (R2S-Receiver)

After accomplishing these activities and testing the configuration, the operational personnel informs the customer about service readiness

The R2S service usage is as follows:

1. The user can utilize any client FTP application (eg, FileZilla client) to transfer its content into the “Hotbox” that has been assigned to. An initial allowance for 20 GB is initially provide and extended, if required.

2. Such contents, after five seconds from their deposit inside the Hotbox, are sequentially sent via satellite channel from the server Relay2Sat-Reliable Multicast.

3. Each receiving remote terminal has previously been configured to have an active R2S-Receiver process, which is capable to reconstruct each one of the contents sent by the R2S-Sender; local record for each received document is performed on the remote side. The same information is also sent back to the R2S-Sender side (central log) in the Teleport through a simple MySQL query (INSERT) as successful acknowledgement for a correct reception.

4. The customer can check and retrieve via Web access all present acks regarding the actual reception of the captured contents for each one of the remote terminals

5 The operative personnel is able through the dedicated CMS to manage and monitor the service status for each of the authorized customers

The following drawing depicts what above represented in the five points above.

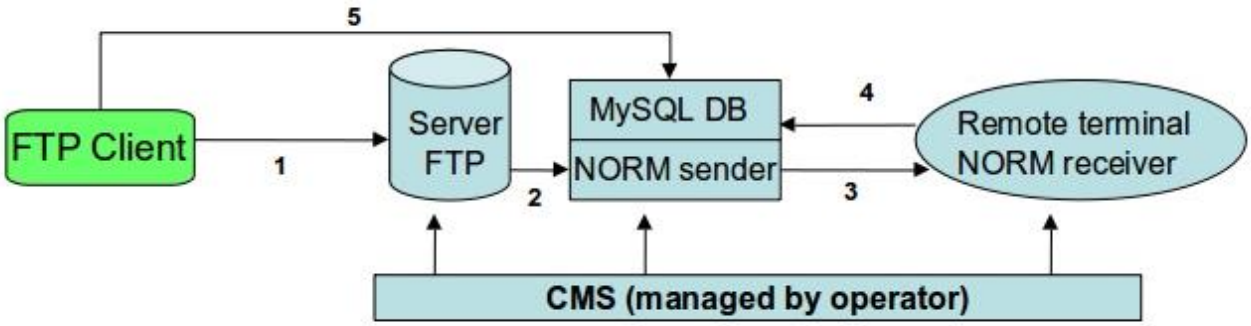


Fig.3 – R2S service flow

CMS description

The Content Management System (CMS) developed for R2S has been designed to allow an agile management of the service by the operating personnel; it is written in PHP and allows easily any tailored upgrade.

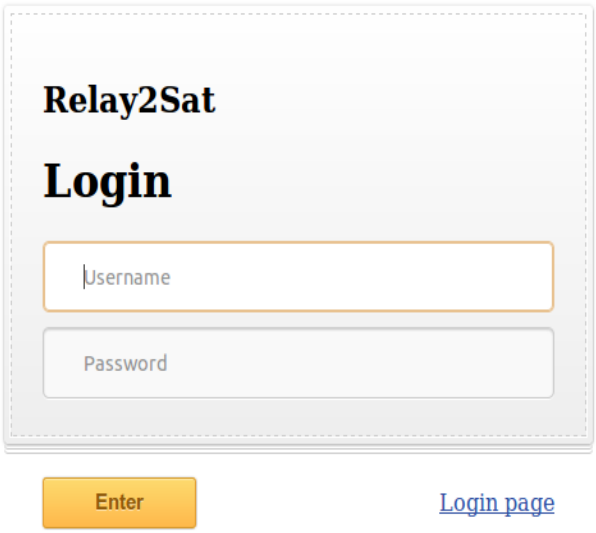
The CMS currently allows :

1. access via the login and log out properly through logout , no CMS page can be called up and viewed without first being authenticated
2. create a new service instance for a customer, assigning addressing, bit rate for transmission to satellite
3. enable and disable a specific service
4. observe the state of services managed by the R2S server
5. archive all services which have to be stopped or deleted
6. observe the central log listing the positive feedback sent from each remote terminal in regard to the files correctly received
7. reactivate all the enabled transmission processes which have been improperly stopped
8. download the operation manual of NORM

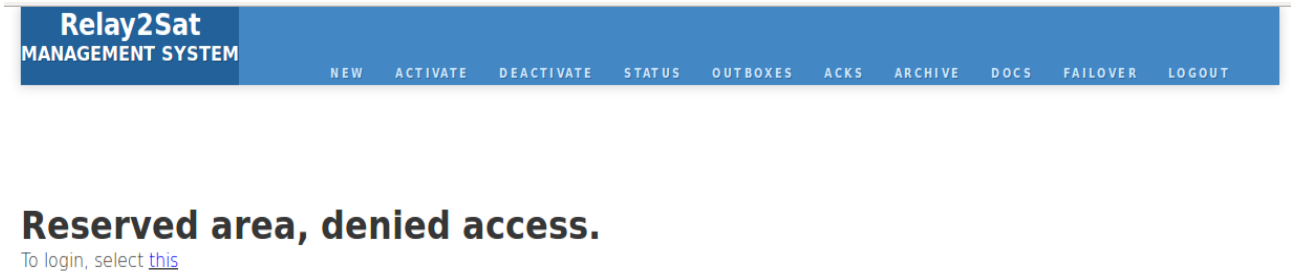
All above listed points are hereafter described in detail.

Operator Login

To access the CMS, the operator has to login to the default page by entering the correct credentials.



Any attempt to access a service page included in the CMS without passing through the login page entails the following warning.



NEW function

The operator can create a new service by assigning an identifier to the client, a multicast address, a UDP port, a transmission bit rate to satellite and an indication whether each content should be transmitted more than once. The UDP port is automatically chosen among a set of default values. In case the used port is not necessary anymore, its value is reintegrated among the active ones to be reused for other services and users.

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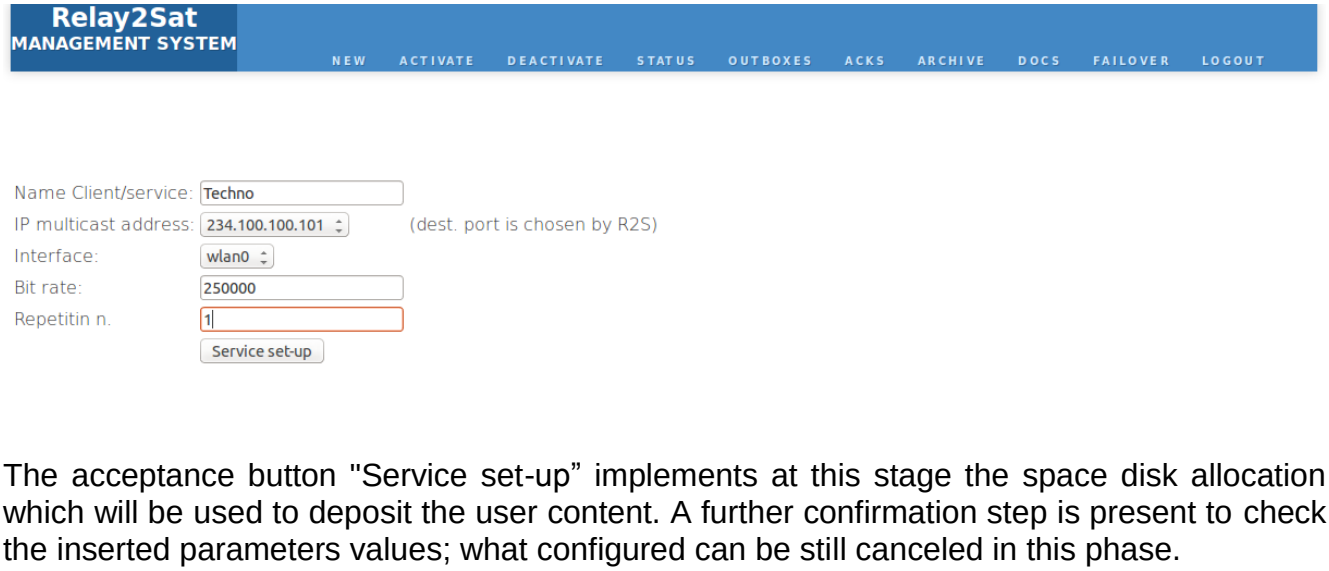
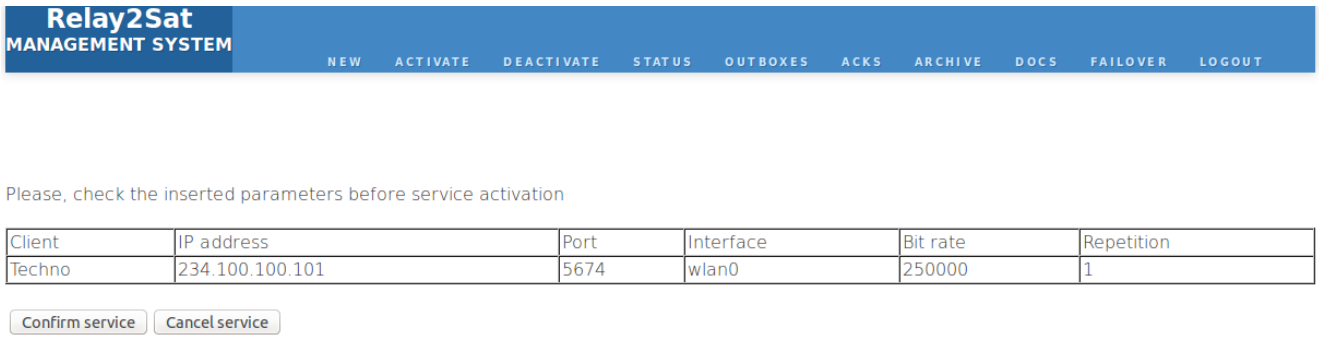


The acceptance button "Service set-up" implements at this stage the space disk allocation which will be used to deposit the user content. A further confirmation step is present to check the inserted parameters values; what configured can be still canceled in this phase.



The following picture shows the allocated HD space for test client "Techno".

A final confirmation page is shown to confirm data insertion in database

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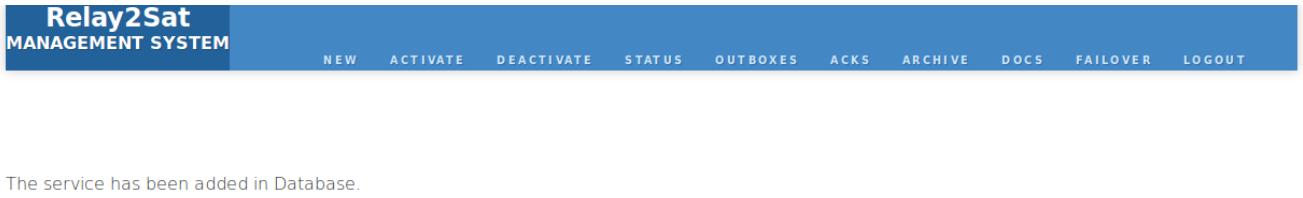
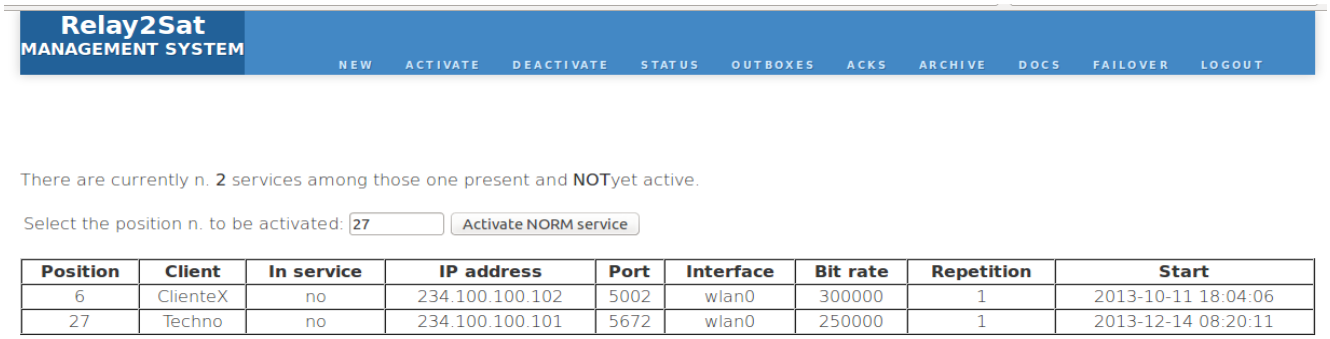
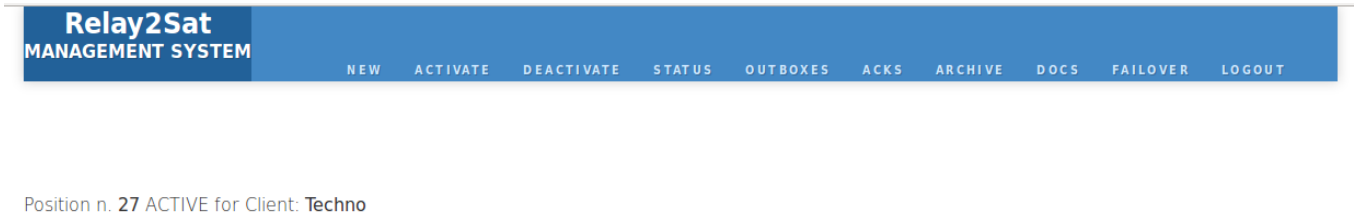


ACTIVATE function

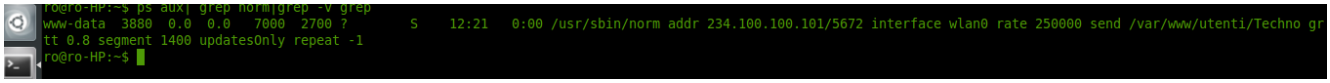
The operator can activate all the service instances which have already been defined. To do that, it is necessary to consider the position number relevant to client/user, select it and press the "Activate NORM service" button.



A confirmation notice of successful service activation will appear.



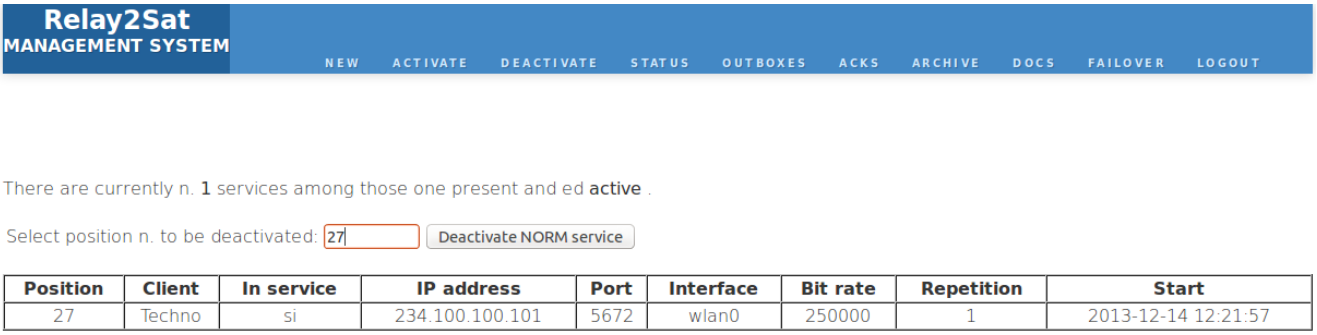
The performed activation means that a NORM instance has been made operational for this specific user. The “norm” application resides in **/usr/sbin** file system folder.



From this moment on, any file posted by the remote FTP client will be properly and automatically managed and transmitted at satellite accordingly with the parameters (options) entered in the CMS.

DEACTIVATE function

The operator is allowed to disable a service only among those ones being activated. The web page shows all the present instances status; again, the interested position number has to be considered to deactivate the service.

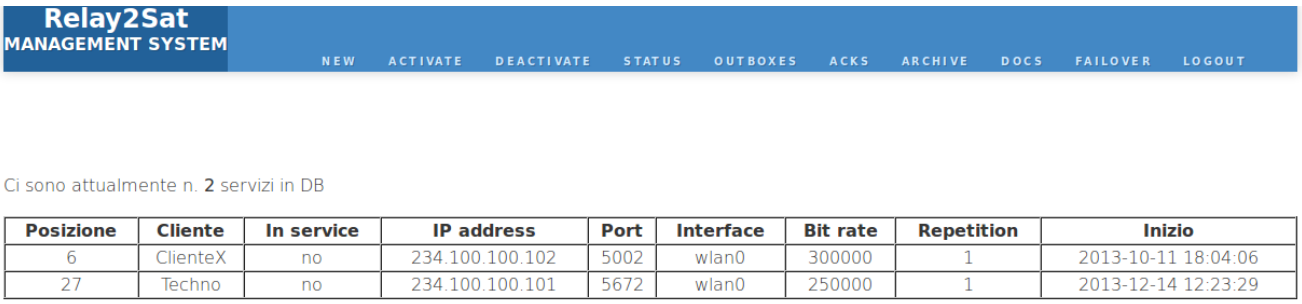


After pressing the deactivation button a feedback is provided by the CMS regarding the disabled service.

The relevant NORM process will therefore be halted.

STATUS function

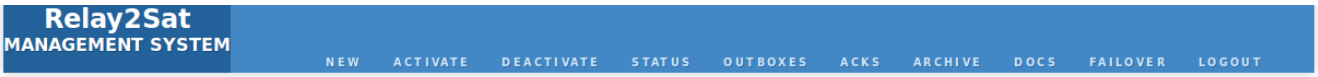
The operator can check the status regarding each individual service.



Information about the “in service” status will appear jointly with other parameters.

OUTBOXES function

This function allows the operator to know all the files being uploaded by the user.

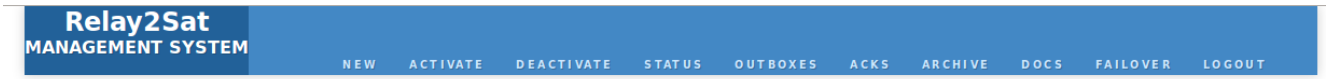


There are currently n. **2** services in Database.

Select position n. : Present files

Position	Client	In service	IP address	Port	Interface	Bit rate	Repetition	Start
6	ClienteX	si	234.100.100.102	5002	wlan0	300000	1	2013-12-14 12:43:40
27	Techno	no	234.100.100.101	5672	wlan0	250000	1	2013-12-27 09:25:42

Pressing the button "Present files" will appear as a list of files as it follows.

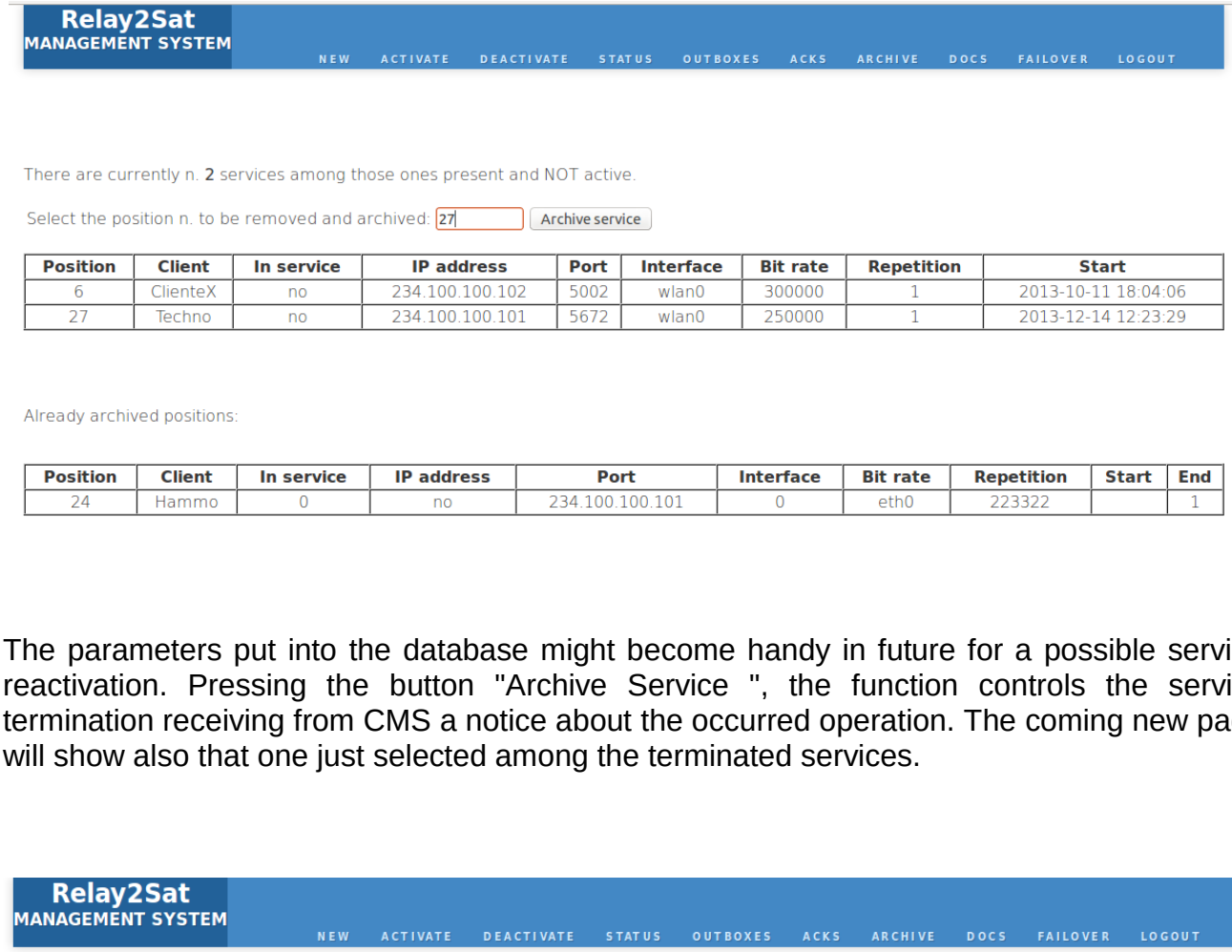


There are currently n. **7 files** in this outbox

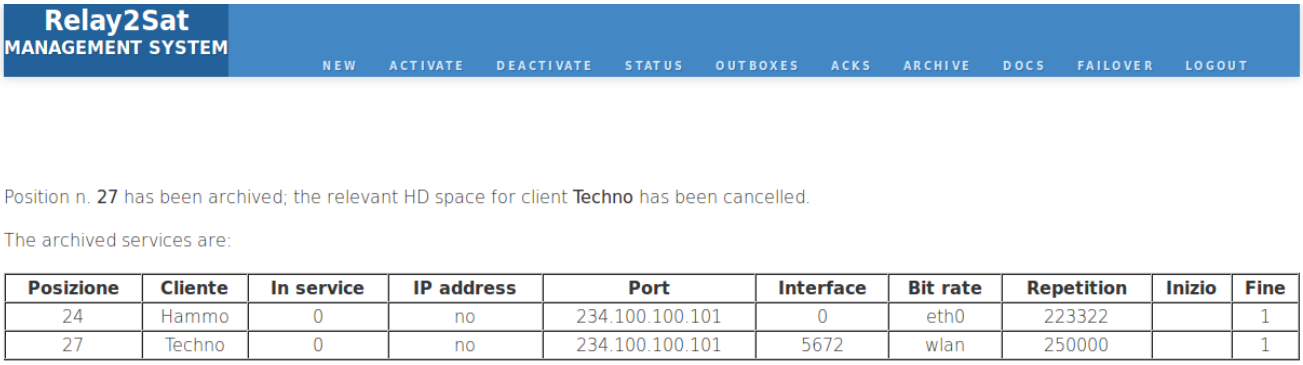
File Name	File Type	File Size
O-OM-LF-LO-INIR-C1342.doc	file	65536
X5.activation.pdf	file	22101
byte.vsat.sh	file	884
config.php	file	1045
functions.php	file	7978
kaiser.txt	file	13350
norm2.sql	file	6378

ARCHIVE function

The operator can choose to permanently delete a service from those not active. This involves not a cancellation but a new record as service history. The function is used selecting the reference client position.

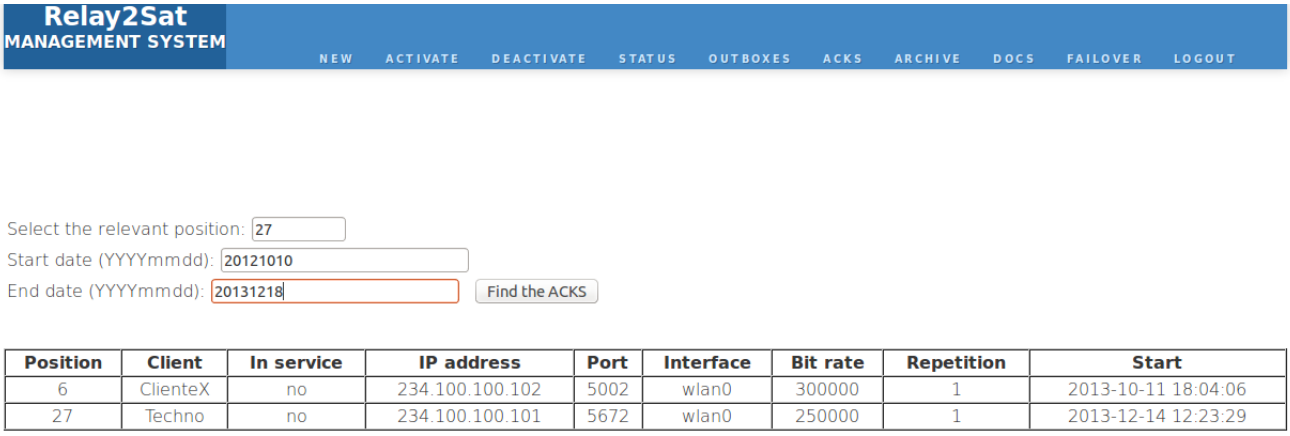


The parameters put into the database might become handy in future for a possible service reactivation. Pressing the button "Archive Service ", the function controls the service termination receiving from CMS a notice about the occurred operation. The coming new page will show also that one just selected among the terminated services.



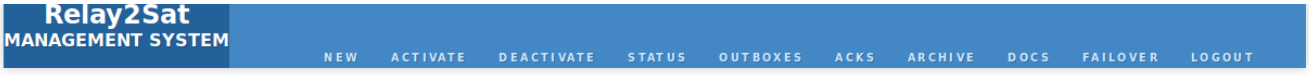
ACKS function

The operator can access an evidence list for all correct file reception; such "acks" (acknowledgments) are sent by each terminal at the end of any correct reception of multicast content by the specific process NORM SENDER. To get this information the operator has to select the position number and a time range defined by a start date and an end date for the required period.



Position	Client	In service	IP address	Port	Interface	Bit rate	Repetition	Start
6	ClienteX	no	234.100.100.102	5002	wlan0	300000	1	2013-10-11 18:04:06
27	Techno	no	234.100.100.101	5672	wlan0	250000	1	2013-12-14 12:23:29

A list of positions (referring to the table of "acks " , not the user one) will be shown; each line refers to client name, specific remote terminal, received file and receipt the date.



There are currently n. **4 acks** in DB

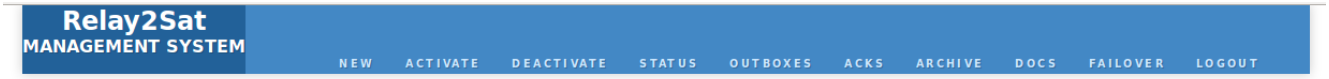
Position	Client	Remote	File	Receive date
1	Techno	c03v13	qwe.avi	2012-12-14 08:16:21
5	Techno	jork	config.php	2013-12-14 12:37:46
7	Techno	VENEZIA	CIAO.AVI	2013-10-14 08:10:04
8	Techno	Jork	norm2.sql	2013-12-14 12:38:21

MANUAL function

Through this function it is possible to download the NORM user manual in PDF format. Any other document may be added.

FAILOVER function

Should the server hosting the R2S service be turned off for whatever reason while working, it is possible to automatically restore all the former activated services following the server and R2S activation. The Failover function has this purpose.



Reactivate now all NORM processes not properly terminated: Reactivate

Pressing the button "Reactivate", all NORM processes which had been (probably) unduly terminated are reactivated. A message will appear indicating the number and names of the services recovered.

LOGOUT function

This function allows the operator to exit from the CMS R2S; cancellation of all the control

R2S configuration

The R2S service has to be properly configured for each specific user; this means that, apart using the CMS web interface to create and activate a new profile, some additional configuration has to be applied by NCC personnel to effectively start the user service.

Two more actions are therefore required:

- Activation of the FTP repository for a user
- Client side configuration and activation

The following chapters just describe these two tasks.

6.1 Repository activation

This requirement is fulfilled by using a simple bash script running inside the R2S server.

The relevant script name is "**attiva-utente-ftp_pure.sh**"; its task is to activate the dedicated ftp repository for that specific user. The script requests that a username and a password be inserted by the NCC operator; these credentials will then have to be recorded and later provided to the user to allow her/him to use any FTP client (e.g., FileZilla) to connect and upload its contents through the R2S server.

To correctly run the script, it is necessary to open the Bash shell inside the R2S server entering from the Home directory the following command:
./attiva-utente-ftp_pure.sh <user-name>
The given <user-name> argument is the first value of the credentials couple.

A prompt asking for password will appear; after inserting the relevant string for twice, the script will immediately make available the user repository.

6.2 Client side configuration

By definition, when referring to a "Client or Receiver side", it is meant a system being composed of a **bidirectional** channel VSAT connected to a local computer appliance,

typically hosting specific processes. Among them, there is the norm session in listening mode (receiver) to collect any transmitted content from the R2S server.
R2S is also capable to work in **"silent mode"**, which means just using a satellite "Receive Only" system being attached to PC having DVBS cards for obtaining multicast streams.
The preferred appliance solution entails a PC mounting a Linux Operating System; Windows based PCs are also considered, but they represent a limited and less flexible solution

- Linux Appliance:

To activate a "norm receiver" process it is required to copy in Home directory the script "**send-ack.sh"** checking its execution permissions. In case it is necessary to provide that, just enter:

chmod 755 send-ack.sh

The second (and last step) is to enter through a Bash the following command from the Home folder:

./norm addr <mcast_ip_address>/<port> rxcachedir . Rxpersist rxbuffer 2000000 processor $HOME/send-ack.sh &

The <**mcast_ip_address>/<port>** parameters must match the unique values which have been assigned to the specific R2S service when using the CMS.
.
The script **"send-ack.sh"** is a *post processing tool* which perform the following tasks.
It creates a **"received"** named folder, should it be already not existing yet. Any time a new file is received, it checks whether such a file is already present in "receiver" folder. If not, it moves the file over there sending also an "ack" message to the R2S server. If present, conversely, a further check is done being based on the received file size. In case this value is greater for the received file, a swap is commanded in the "received" folder.

- Windows Appliance:

When dealing with a Windows PC, it is necessary to install the Cygwin software package (http://www.cygwin.com/), as it provides in a Windows environment the same Bash tools being present using Linux. Cygwin will have to be installed including the MySQL client package.
The "**send-ack.sh"** will have to be placed in Home directory, typically **"c:\Cygwin\home"** while the norm executable "norm.exe" may be put in **"C:\Cygwin\bin"** repository.
To activate the process for content reception (PC in listening mode), the same instructions as before apply.